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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 20256 WO	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/NL 03/00057	International filing date *(day/month/year)* 28.01.2003	Priority date *(day/month/year)* 29.01.2002
International Patent Classification (IPC) or both national classification and IPC C08L23/16		
Applicant DSM IP Assets B.V.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
18.08.2003	28.07.2004
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Bergmans, K Telephone No. +31 70 340-4189

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NL 03/00057

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-13 as originally filed

Claims, Numbers

1-12 received on 01.07.2004 with letter of 30.06.2004

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-12
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-12
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item I

The amendment filed with the letter dated 30/06/2004 introduce subject-matter which extend beyond the content of the application as filed, contrary to Article 34(2)(b) PCT. The amendment concerned in claim 4 is the following: "...0-70 parts by weight of oil...". The description of present application does not support this amendment, and discloses an amount of oil present between 0-60 parts by weight (page 5).
Since this amendment go beyond the disclosure in the international application as filed, the report shall be established as if such amendment had not been made, and the report shall so indicate (Rule 70.2© PCT).

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Novelty (Art. 33 (2) PCT)

1. The document D1 (EP0976783) discloses a process for the preparation of a thermoplastic elastomer comprising a polypropylene, an at least partially vulcanized rubber and a vulcanizing agent (claim 1). The rubber is an ethylene-propylene diene rubber and the curing agent is a phenolic curative (claims 4,5). The dynamical vulcanisation is executed by an extruder (twin screw extruder) and optionally, oils are used in the process (claim 8 and page 3 line 26). The amount of extractable rubber is less than 5 weight % (claim 7). The difference with the present application is the post-curing of the composition.

2. The document D2 (EP0844278) discloses a polyolefin composition comprising A) a propylene polymer material (70-40 %) and B) a partially crosslinked thermoplastic olefin elastomer (30-60 %) composition comprising B1) a propylene homopolymer (20-70%) and B2) an ethylene-propylene diene terpolymer (30-75 %) (see claim 1). The curing agent for the partially crosslinked thermoplastic elastomer is a peroxide curing system and the curing is done by dynamical vulcanisation (page 5 lines 35-40). The gel content of the partially crosslinked thermoplastic elastomer is between 80 % and 94 % (page 5 lines 49-50). The composition can also contain additives like extender oils such a paraffinic or naphthenic oils (page 7 line 4). The compounding or melt blending of the components is carried out by a single screw extruder or twin screw extruder (page 7 lines 1-3). The different with the present application is the post-curing of the composition.

3. The document D3 (WO9601291) discloses a thermoplastic elastomeric composition comprising
A) an engineering thermoplastic resin (claim 1) like polyamide, polyester, polyimide, etc. (see claim 3 document D3), B) cured rubber concentrate (claim 1)
B1) curable elastomeric rubber like ethylene-propylene diene rubber (claim 4)
B2) polymeric carrier like typical thermoplastic polymers (page 12 lines 18-23)
B3) curing agent like peroxide or sulfur (page 16 lines 1-9)
Optionally, additives like rubber processing oil, extender oil and lubricants can be present in the thermoplastic composition (claim 1, page 13 lines 20-30).The dynamical vulcanisation is carried out with a single screw extruder or twin screw extruder (page 15 lines 10-30). The different with the present application is the post-curing of the composition.

4. The document D4 (EP0361205) discloses a "plasto-elastomeric" composition (claim 1) comprising
A) not crosslinked polypropylene (10-50 %)
B) polymeric product substantially insoluble in xylene and comprising polypropylene and ethylene-propylene-diene terpolymer (30-45 %)
C) extender oil (5-58 %)
The polymeric product (B), is a derived product of crosslinked polypropylene and an ethylene-propylene-diene terpolymer (EPDM). The crosslinked is done by a peroxide crosslinking agent (page 4 lines 7-24). The dynamical vulcanisation is carried out with a single screw extruder or twin screw extruder (page 6 lines 36-37).
The different with the present application is the post-curing of the composition.

In view of the prior art cited, claims 1-12 appear to be novel an meet therefore the requirements of Art. 33(2) PCT.

Inventive step (Art. 33(3) PCT)

The document D1 (EP0976783) discloses a process for the preparation of a thermoplastic elastomer comprising a polypropylene, an at least partially vulcanized rubber and a vulcanizing agent (claim 1). The rubber is an ethylene-propylene diene rubber and the curing agent is a phenolic curative (claims 4,5). The dynamical vulcanisation is executed by an extruder (twin screw extruder) and optionally, oils are used in the process (claim 8 and page 3 line 26). The amount of extractable rubber is less than 5 weight % (claim 7).

The subject-matter of claims 1-12 differs from this known D1 in the post-curing of the composition. The problem to be solved by the present invention may therefore be regarded as a process for the preparation of a thermoplastic elastomer by melt mixing and wherein the thermoplastic elastomer has improved properties (e.g. hardness, tensile strength, and modulus). The solution proposed in claims 1-12 of the present application is considered as inventive (Art. 33(3) PCT) because it was not known from the prior art that a process for the preparation of a thermoplastic elastomer by melt mixing and post-curing of a thermoplastic elastomer composition would improve the properties (hardness, tensile strength, and modulus) of the thermoplastic elastomer.

Re Item VIII

Certain observations on the international application

Clarity (Art. 6 PCT)

1. Claim 1 does not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The following functional statement "partially vulcanized rubber concentrate" does not enable the skilled person to determine which technical features are necessary to perform the stated function. Contrary to what is disclosed in the description (page 4) of present application, the term "partially" used in claim 1 indicates that the amount of vulcanised rubber can be between 0.1 and 99.9 %.

2. The relative term "concentrate" used in claim 1 has no well-recognised meaning and leave the reader in doubt as to the meaning of the technical feature to which it refers, thereby rendering the definition of the subject-matter of said claim unclear, Article 6 PCT.

AMENDED CLAIMS

1. Process for the preparation of a thermoplastic elastomer by melt mixing (100)
   a) partially vulcanized rubber concentrate which is prepared by melt mixing:
      - at least one elastomer and optionally oil (e)
      - at least one thermoplastic polymer (f)
      - a curing agent (g)
   b) a thermoplastic polymer and/or additives
   c) optionally oil and
   d) a curing agent to initiate a further dynamic vulcanization.
2. Process according to claim 1 characterized in that the melt mixing is carried out in a twin-screw extruder.
3. Process according to claim 1 characterized in that the melt mixing is carried out in a single screw extruder.
4. Process according to claim 1 characterized in that the partially vulcanized rubber concentrate is prepared by melt mixing
   e) 30 to 95 parts by weight of the elastomer(s) and 0-70 parts by weight of oil.
   f) 5 to 50 parts by weight of the thermoplastic polymer(s)
   g) 0,1-10 parts by weight of the curing agent and
   whereby the sum of the parts by weight of the elastomer(s), the thermoplastic polymer(s), curing agent and oil is 100.
5. Process according to any one of claims 1-4 characterized in that the elastomer is EPDM or EPM.
6. Process according to claim 1-5 characterized in that the thermoplastic polymer is chosen from thermoplastic polyolefin homo- and copolymers, reactor TPO, polyamides, polycarbonate, polyesters, polysulfones, polylactones, polyacetals, acrylonitrile-butadiene-styrene (ABS) resins, polyphenylene oxide (PPO), polyphenylene sulfide (PPS), styrene-acrylonitrile (SAN) resins, polyimides, styrene maleic anhydride (SMA) and aromatic polyketones.
7. Process according to claim 6 characterized in that the thermoplastic polymer is a thermoplastic polyolefin homo- and copolymer.
8. Process according to claim 7 characterized in that the thermoplastic polymer is a polypropylene homopolymer.
9. Process according to any one of claims 1-8 characterized in that the elastomer in the partially vulcanized rubber concentrate has a gel content higher than 50%.
10. Process according to any one of claims 1-9 characterized in that the elastomer in the partially vulcanized rubber concentrate has a gel content higher than 70%
11. Process for the preparation of a thermoplastic elastomer according to claims 1-10 by melt mixing:
    a) 10-90 parts by weight of the partially vulcanized rubber concentrate
    b) 90-10 parts by weight of a the thermoplastic polymer and/or additives
    c) 0-30 parts by weight of oil
    d) 0,1-10 parts by weight of the curing agent
    whereby the sum of the parts by weight of the partially vulcanized rubber concentrate, the thermoplastic polymer and/or additives, the oil and the curing agent is 100.
12. Process according to any one of claims 1-11 characterized in that the curing agent is chosen from phenol resins, siloxanes or peroxides.